Bendix

Aerospace Systems Division

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Temperature Sensor Calibration Results - Central Station Sensors	ATM-793	
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This ATM documents the results of calibration tests performed on Fenwal Model GB42MM62 and Tylan FG108N temperature sensors. The calibration was performed on a sample lot of 30 GB42MM62 sensors and on a sample lot of 7 FG108N sensors.

The results of the tests indicate that all the GB42MM62 sensors tested tracked the standard predicted curve within 0.59°F at the selected calibration points; all FG108N sensors tested tracked the standard predicted curve within 2.6°F. The results of the test indicate that the sensor performance is quite satisfactory and permits the requirements of the SE-03, Measurement Requirements Document to be fulfilled.

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GENERAL

Special calibration tests were performed on 30 ea. Fenwal GB42MM62 thermistors and 7 ea. Tylan FG108 surface temperature sensors to confirm that the sensors track the standard predicted curve to within sufficient accuracy to permit a standard calibration curve usage for each type sensor and yet maintain measurement accuracy per the SE-03 Measurements Requirements Document.

The FG108N sensor network is required per SE-03 to measure temperature to an accuracy of $\pm 15^{\circ}F$ over a temperature span between $-300^{\circ}F$ and $+300^{\circ}F$. The sensor complement per system is as follows:

HK15	Bottom Structure Temp.
HK27	Sunshield Temp. #1
HK42	Sunshield Temp #2
HK59	Left Side Structure Temp.
HK60	Inner Multilayer Insulation Temp.
HK72	Outer Multilayer Insulation Temp.
HK87	Right Side Structure Temp.
HK88	PDM Temperature

The GB42MM62 sensor network is required per SE-03 to monitor temperatures to an accuracy of $\pm 10^{\circ}F$ over a temperature span of $-50^{\circ}F$ to $+200^{\circ}F$. The sensor complement per system is:

HK04	Thermal Plate #2 Temp.
HK28	Thermal Plate #2 Temp.
HK33	Analog Data Processor Base Temp.
HK34	Analog Data Processor Internal Temp.
HK43	Thermal Plate #3 Temp.
HK46	Digital Data Processor Base Temp.
HK47	Digital Data Processor Internal Temp.
HK48	Command Decoder Base Temp.
HK49	Command Decoder Internal Temp.
HK58	Thermal Plate Temp. #4
HK61	Command Decoder VCO Temp.
HK62	PDU Base Temp.
HK63	PDU Internal Temp.
HK64	PCU Oscillator #1 Temp.
HK71	Thermal Plate Temp. #5
HK76	PCU Oscillator #2 Temp.
HK77	PCU Regulator #1 Temp.
HK78	PCU Regulator #2 Temp.

CALIBRATION DATA

The Calibration Data, Table 1 tabulates device serial number in Column 1 and the device model and manufacturer in Column 2. Column 3 tabulates the calibration temperature points for each sensor and Column 4 records the resistance reading of the device at the noted temperature; Column 5 is the value of resistance derived from standard calculated data sheets, Column 6 is the deviation (difference) in ohms of the actual device(s) resistance from the calculated standard curve value. The value of Column 6 when divided by the sensitivity (Column 7) provides the deviation (error) resulting from using standard curve data rather than actual calibration data. This "error" is tabulated in Column 8.

SN	Temperature Sensor Model/ Manufacturer	Calib. Temp. (°F)	R_m(ohms) Resist. Measured	R_c(ohms) Resist. Calculated	$\triangle R = R_m - R_c$	S = Sensitivity ohms/°F	Error = $\frac{\triangle R}{S}$ (°F)
83	FG108N/Tylan	-320.2	187.0	190	-3.0	2.0	-1.5
		-109.3	1145.2	1142.5	+2.7	5.0	0.54
		+32	1996.1	2000.0	-3.9	7.0	-0.56
		+100	2463.6	2472.0	-8.4	7.26	-1.16
		+300	4137.8	4142.0	-4.2	9.40	-0.45
129	FG108N/Tylan	-320.2	194.0	190	+4.0	2.0	2.0
		-109.3	1152.5	1142.5	+10.0	5.0	2.0
		+32	2003.7	2000.0	+3.7	7.0	0.53
		+100	2461.8	2472.0	-10.2	7.26	-1.40
		+300	4129.2	4142.0	-12.8	9.40	-1.36
136	FG108N/Tylan	-320.2	193.9	190	+3.0	2.0	1.5
		-109.3	1149.7	1142.5	+7.2	5.0	1.44
		+32	1999.0	2000.0	-1.0	7.0	-0.14
		+100	2465.7	2472.0	-6.3	7.26	-0.87
		+300	4122.7	4142.0	-19.3	9.40	-2.05
140	FG108N/Tylan	-320.2	194.5	190	+4.5	2.0	2.3
		-109.3	1154.0	1142.5	+11.5	5.0	2.3
		+32	2005.0	2000.0	+5.0	7.0	0.71
		+100	2464.9	2472.0	-7.1	7.26	-0.98
		+300	4131.5	4142.0	-10.5	9.40	-1.12
141	FG108N/Tylan	-320.2	193.6	190	+3.6	2.0	1.80
		-109.3	1150.1	1142.5	+7.6	5.0	1.52
		+ 32.0	2000.8	2000.0	+0.8	7.0	0.11
		+100.0	2465.9	2472.0	-6.1	7.26	-0.84
		+300	4127.9	4142.0	-14.1	9.4	-1.50

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SN	Temperature Sensor Model/ Manufacturer	Calib. Temp. (°F)	R_m(ohms) Resist. Measured	R_c(ohms) Resist. Calculated	$\Delta R = R_m - R_c$	S = Sensitivity ohms/°F	Error = $\frac{\Delta R}{S}$ (°F)
142	FG108N/Tylan	-320.2	194.4	190	+4.4	2.0	2.2
		-109.3	1154.1	1142.5	+11.6	5.0	2.32
		+ 32	2002.5	2000.0	+2.5	7.0	0.36
		+100	2465.7	2472.0	-6.3	7.26	-0.87
		+300	4131.4	4142.0	-10.6	9.40	-1.13
143	FG108N/Tylan	-320.2	194.7	190	+4.7	2.0	2.35
		-109.3	1155.6	1142.5	+13.1	5.0	2.62
		+ 32	2007.2	2000.0	+7.2	7.0	1.03
		+100	2468.7	2472.0	-3.3	7.26	-0.45
		+300	4136.5	4142.0	-5.5	9.40	-0.59
3	GB42MM62/Fenwal	- 40	372,144	370,600	1,544	-11,760	-0.13
		+ 32	44,121	44,460	- 339	-1120	+0.30
		+140	4,133	4,160	- 27	-75	+0.36
		+212	1,248	1,249	- 1	-18	+0.06
4	GB42MM62/Fenwal	- 40	371,268	370,600	668	-11760	-0.06
		+ 32	44,120	44,460	-340	-1120	+0.30
		+140	4,154	4,160	- 6	-75	+0.08
		+212	1,258	1,249	9	-18	-0.50
9	GB42MM62/Fenwal	- 40	374,844	370,600	4244	-11760	-0.36
		+ 32	44,246	44,460	-214	-1120	+0.19
		+140	4,138	4,160	- 22	-75	+0.29
		+212	1,249	1,249	0	-18	-0.00
13	GB42MM62/Fenwal	- 40	372,351	370,600	1751	-11760	-0.15
		+ 32	44,237	44,460	- 223	-1120	+0.20
		+140	4,163	4,160	3	-75	-0.04
		+212	1,259	1,249	10	-18	-0.56
17	GB42MM62/Fenwal	- 40	371,698	370,600	1098	-11760	-0.09
		+ 32	44,116	44,460	-344	-1120	+0.31
		+140	4,144	4,160	- 16	-75	+0.21
		+212	1,251	1,249	2	-18	-0.11

SN	Temperature Sensor Model/ Manufacturer	Calib. Temp. (°F)	R_m (ohms) Resist. Measured	R_c (ohms) Resist. Calculated	$\Delta R = R_m - R_c$	S = Sensitivity ohms/°F	Error = $\frac{\Delta R}{S}$ (°F)
21	GB42MM62/Fenwal	- 40	373,651	370,600	3051	-11760	-0.26
		+ 32	44,102	44,460	-358	-1120	+0.32
		+140	4,127	4,160	-33	-75	+0.44
		+212	1,246	1,249	-3	-18	+0.17
22	GB42MM62/Fenwal	- 40	373,757	370,600	3157	-11760	-0.27
		+ 32	44,212	44,460	-248	-1120	+0.22
		+140	4,144	4,160	-16	-75	+0.21
		+212	1,250	1,249	1	-18	-0.06
23	GB42MM62/Fenwal	- 40	373,880	370,600	3280	-11760	-0.28
		+ 32	44,283	44,460	-177	-1120	+0.16
		+140	4,154	4,160	-6	-75	+0.08
		+212	1,253	1,249	4	-18	-0.22
25	GB42MM62/Fenwal	- 40	373,156	370,600	2556	-11760	-0.22
		+ 32	44,126	44,460	-334	-1120	+0.30
		+140	4,130	4,160	-30	-75	+0.40
		+212	1,244	1,249	-5	-18	+0.28
26	GB42MM62/Fenwal	- 40	370,980	370,600	380	-11760	-0.03
		+ 32	44,032	44,460	-428	-1120	+0.38
		+140	4,151	4,160	-9	-75	+0.12
		+212	1,258	1,249	9	-18	-0.50
27	GB42MM62/Fenwal	- 40	373,703	370,600	3103	-11760	-0.26
		+ 32	44,223	44,460	-237	-1120	+0.21
		+140	4,143	4,160	-17	-75	+0.23
		+212	1,249	1,249	0	-18	-0.00
28	GB42MM62/Fenwal	- 40	371,245	370,600	645	-11760	-0.05
		+ 32	44,223	44,460	-237	-1120	+0.21
		+140	4,131	4,160	-29	-75	+0.39
		+212	1,246	1,249	-3	-18	+0.17

SN	Temperature Sensor Model/ Manufacturer	Calib. Temp. (°F)	R_m (ohms) Resist. Measured	R_c (ohms) Resist. Calculated	$\Delta R = R_m - R_c$	S = Sensitivity ohms/°F	Error = $\frac{\Delta R}{S}$ (°F)
29	GB42MM62/Fenwal	- 40	369,500	370,600	-1100	-11760	+0.09
		+ 32	44,193	44,460	-267	-1120	+0.24
		+140	4,136	4,160	-24	-75	+0.32
		+212	1,245	1,249	-4	-18	+0.22
30	GB42MM62/Fenwal	- 40	371,398	370,600	798	-11760	-0.07
		+ 32	44,066	44,460	-394	-1120	+0.35
		+140	4,143	4,160	-17	-75	+0.23
		+212	1,248	1,249	-1	-18	+0.06
35	GB42MM62/Fenwal	- 40	371,598	370,600	998	-11760	-0.08
		+ 32	44,130	44,460	-330	-1120	+0.29
		+140	4,158	4,160	-2	-75	+0.03
		+212	1,259	1,249	10	-18	-0.56
36	GB42MM62/Fenwal	- 40	371,434	370,600	834	-11760	-0.07
		+ 32	44,068	44,460	-392	-1120	+0.35
		+140	4,141	4,160	-19	-75	+0.25
		+212	1,250	1,249	-1	-18	+0.06
43	GB42MM62/Fenwal	- 40	372,157	370,600	1557	-11760	-0.13
		+ 32	44,039	44,460	-421	-1120	+0.38
		+140	4,133	4,160	-27	-75	+0.36
		+212	1,247	1,249	-2	-18	+0.11
44	GB42MM62/Fenwal	- 40	372,880	370,600	2280	-11760	-0.19
		+ 32	44,136	44,460	-324	-1120	+0.29
		+140	4,138	4,160	-22	-75	+0.29
		+212	1,248	1,249	-1	-18	+0.06
50	GB42MM62/Fenwal	- 40	371,944	370,600	1344	-11760	-0.11
		+ 32	44,133	44,460	-327	-1120	+0.29
		+140	4,145	4,160	-15	-75	+0.20
		+212	1,252	1,249	3	-18	-0.17

SN	Temperature Sensor Model/ Manufacturer	Calib. Temp. (°F)	R_m(ohms) Resist. Measured	R_c(ohms) Resist. Calculated	$\Delta R = R_m - R_c$	S = Sensitivity ohms/°F	Error = $\frac{\Delta R}{S}$ (°F)
51	GB42MM62/Fenwal	- 40	373,334	370,600	2734	-11760	-0.23
		+ 32	44,262	44,460	-198	-1120	+0.18
		+140	4,141	4,160	-19	-75	+0.25
		+212	1,248	1,249	-1	-18	+0.06
52	GB42MM62/Fenwal	- 40	373,234	370,600	2634	-11760	-0.22
		+ 32	44,168	44,460	-292	-1120	+0.26
		+140	4,139	4,160	-21	-75	+0.28
		+212	1,249	1,249	0	-18	-0.00
56	GB42MM62/Fenwal	- 40	372,040	370,600	1440	-11760	-0.12
		+ 32	44,103	44,460	-357	-1120	+0.32
		+140	4,142	4,160	-18	-75	+0.24
		+212	1,252	1,249	3	-18	-0.17
61	GB42MM62/Fenwal	- 40	374,358	370,600	3758	-11760	-0.32
		+ 32	44,358	44,460	-102	-1120	+0.09
		+140	4,141	4,160	-19	-75	+0.25
		+212	1,253	1,249	4	-18	-0.22
65	GB42MM62/Fenwal	- 40	372,958	370,600	2358	-11760	-0.20
		+ 32	44,157	44,460	-303	-1120	+0.27
		+140	4,138	4,160	-22	-75	+0.29
		+212	1,248	1,249	-1	-18	+0.06
69	GB42MM62/Fenwal	- 40	373,229	370,600	2629	-11760	-0.22
		+ 32	44,135	44,460	-325	-1120	+0.29
		+140	4,138	4,160	-22	-75	+0.29
		+212	1,250	1,249	1	-18	-0.06
81	GB42MM62/Fenwal	-40	372,552	370,600	1952	-11760	-0.17
		+ 32	44,088	44,460	-372	-1120	+0.33
		+140	4,126	4,160	-34	-75	+0.45
		+212	1,243	1,249	-6	-18	+0.33

SN	Temperature Sensor Model/ Manufacturer	Calib. Temp. (°F)	R_m(ohms) Resist. Measured	R_c(ohms) Resist. Calculated	$\triangle R = R_m - R_c$	S = Sensitivity ohms/°F	Error = $\frac{\triangle R}{S}$ (°F)
82	GB42MM62/ Fenwal	- 40	373,510	370,600	2910	-11760	-0.25
		+ 32	44,169	44,460	-291	-1120	+0.26
		+140	4,143	4,160	-17	-75	+0.23
		+212	1,252	1,249	3	-18	-0.17
83	GB42MM62/ Fenwal	- 40	377,521	370,600	6921	-11760	-0.59
		+ 32	44,490	44,460	30	-1120	-0.03
		+140	4,172	4,160	12	-75	-0.16
		+212	1,252	1,249	3	-18	-0.17
85	GB42MM62/ Fenwal	- 40	374,086	370,600	3486	-11760	-0.30
		+ 32	44,298	44,460	-162	-1120	+0.14
		+140	4,159	4,160	-1	-75	+0.01
		+212	1,259	1,249	10	-18	-0.56
88	GB42MM62/ Fenwal	- 40	373,774	370,600	3174	-11760	-0.27
		+ 32	44,292	44,460	-168	-1120	+0.15
		+140	4,163	4,160	3	-75	-0.04
		+212	1,259	1,249	10	-18	-0.56